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(71) Applicant: **Atlanta Stretch S.p.A.**
47838 Riccione (IT)

(72) Inventor: **Forni, Angelo**
47838 Riccione (IT)

(74) Representative: **Porsia, Dino et al**
c/o Succ. Ing. Fischetti & Weber
Via Caffaro 3/2
16124 Genova (IT)

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(54) **Apparatus for placing a covering sheet over the top of palletized loads during wrapping with stretch film**

(57) The apparatus for automatically placing a covering sheet over the top of a load, usually palletized, during wrapping with stretch film, comprises a dispensing gripper (4) which retains the front end of a film unwound from a parallel reel (3) supported rotatably by special means (2) and which leaves, free, portions of the said front end of the film, which are gripped in phase synchronism by the hands (11, 111) of a pivoting-arm manipulator (14, 114) which, in synchronism with temporary opening of the said gripper, is actuated so as to extract from the latter a section of film with the length necessary for forming the said sheet for covering the load. The sheet is

retained at the tail end by the same gripper when actuated so as to close and is then separated from the film downstream by the intervention of transverse cutting means (9). Means are provided for subsequently causing the said manipulator to pivot about its own fulcrum so as to deposit the sheet of film (103) with sufficient centering, over the top of the load (C) to be wrapped which is temporarily stationary, following which the said manipulator abandons the sheet and returns, with a pivoting movement in the opposite direction to the previous pivoting movement, into the position useful for repetition of a new working cycle.

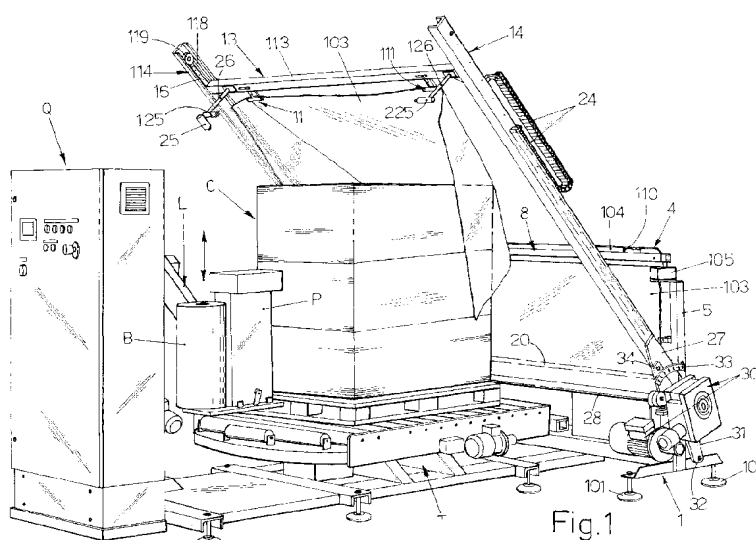


Fig.1

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Description

[0001] The invention relates to an apparatus for automatically placing a sheet of covering film over the top of palletized loads during wrapping with a stretch film. The apparatus in question differs from apparatus of the known type owing to a greater constructional simplicity, a greater technological reliability and in that it may be dispatched to the working location ready assembled and already substantially prepared for use, this owing to the fact that the said apparatus may be arranged with its components in a rest position characterized by a compact volume. This feature is essentially possible as a result of the use of a sheet-positioning device with pivoting arms which, in the rest position, may be stowed away downwards so as to reduce considerably the heightwise volume of the apparatus in question. Further characteristic features of the invention and the advantages arising therefrom will emerge more clearly from the following description of a preferred embodiment thereof, illustrated purely by way of a non-limiting example, in the figures of the three accompanying illustrations in which:

Fig. 1 shows a perspective view of a rotating-table wrapping machine provided with the apparatus according to the invention which is shown during application of a sheet for covering the top of a palletized load during wrapping on said table;

Fig. 2 shows a front elevation view of the apparatus, viewed from the end directed towards the load to be covered;

Fig. 3 shows other details of the apparatus cross-sectioned transversely along the line III-III of Figure 2;

Fig. 4 shows details viewed according to the cross-section IV-IV of Figure 3;

Figs. 5 and 6 show other details of the apparatus viewed according to the cross-section V-V of Figure 2;

Fig. 7 is a schematic top plan view of the means according to Figure 6.

[0002] In Figure 1 T denotes the rotating table of a wrapping machine on which the palletized load C is placed, said load, during rotation, being wound laterally, in a tight and rigidly held manner, with a helical turn of stretch film dispensed by a feeding unit which comprises the reel B of film and a pre-stretching storage unit P and which is mounted on vertical handling means consisting, for example, of an robot arm L which is situated behind the electric control panel Q. The apparatus in question is particularly suitable for association with rotating-table wrapping means of the type shown in Figure 1 or an equivalent type, but must also be understood as protected in combination with any other type of wrapping machine.

[0003] The apparatus according to the invention envisages depositing, on top of the load C during wrapping

on the rotating table, a sheet of film 103 having dimensions such as to cover the said load and so to be then incorporated and fixed with its perimetral edges during the lateral wrapping of the load with stretch film by the wrapping unit B,P, using any one of the known methods which are not considered here in detail since they are not necessary for understanding the invention, in respect of which the sheet 103 is able to perform solely dust-protection functions or also waterproofing functions.

[0004] The apparatus according to the invention is located, for example, on the side of the rotating table T opposite to that occupied by the means L, B, P of the wrapping machine and comprises, parallel to this side, a robust base structure 1 which rests on the ground with adjustable feet 101 and which is provided at the bottom with telescopic parts 201 for fixing to the base of the rotating table T and which supports, parallel to its axis, two rows of rollers 2 which are horizontal and mutually coplanar and on which the reel 3 containing a film with a thickness and width useful for forming the sheets 103 covering the load C is rotatably mounted. The front end of the film unwound from the reel 3 is retained by a transverse dispensing gripper 4 which is positioned parallel to and above the said reel 3 and supported by the ends of upper brackets 105 of a pair of uprights 5 which are integral with the base 1 and which comprises a jaw 104 fixed to the said brackets 105 and a movable jaw 204 for example with an L-shaped profile which travels on guide blocks 6 with a low coefficient of friction and which is displaced by the action of a pair of small fluid-pressure cylinder and piston units 7 which are fixed, for example, with their body, to the outer side of the movable jaw and which, with their stem, pass with play through corresponding holes formed in the said movable jaw and are fixed to the stationary jaw, as can be seen from the detail in Figure 5 which shows the gripper 4 open. At least one or both the internal and opposite surfaces of the jaws 104, 204 may be lined with a layer of rubber.

[0005] Figures 6 and 7 show the gripper 4 closed during the function of retaining the front end of the film 103 and also show how the outer side of the fixed jaw 104 has, mounted thereon in a parallel manner, a rectilinear movement actuator 8 which is also supported by the ends of the brackets 105 and on which there travels a carriage 108 which supports a double-acting blade 9 which is positioned transversely, flat and just above the gripper 4 with its active part which has the shape of a spear head and the inclined sides of which are both sharpened. The carriage 108 usually at rest at one of the two ends of the actuator 8 so as to position the blade 9 at a short distance from one of the sides of the front end of the film 103 retained by the gripper 4 which, as can be seen from Figures 1, 2, 5-7, is provided at the ends with slits 10, 110 which are open upwards and through which corresponding portions of the front end of the film retained by the said dispensing gripper 4 are accessible. These portions of the film may be gripped in phase synchronism by a pair of hands 11, 111 which are mounted with the

associated self-centering actuators 12, 112 on the cross-piece 113, parallel to the underlying gripper 4, of a carriage 13 which with its sides 213, 213' travels on a pair of straight and parallel manipulator arms 14, 114 which, at the start of each working cycle, are in a vertical position as shown in Figures 2, 3 and 5.

[0006] From the details in Figure 4 it can be seen that the sides 213, 213' of the carriage 13 travel with a pair of grooved wheels 15 on the parallel sides of straight guides 16 which are fixed longitudinally inside the arms 14, 114 and it can also be seen that, with an ancillary part 17, the said sides 213, 213' of the carriage are fixed to the section of respective toothed belts 18, 118 which are endlessly wound and driven on drive pulleys 19 mounted on the bottom end of the said arms and on pulleys 119 which are mounted idle and adjustable on the top end of the said arms 14, 114. The drive pulleys 19 are keyed onto a shaft 20 which is mounted rotatably on the bottom ends of the said arms 14, 114, one of which supports, fixed externally, a small reduction unit 21 with an electric motor rotating in both directions which actuates said shaft 20 which is provided on the other end (see Fig. 4) with a wheel having teeth, holes or eyelets 22 with which a proximity sensor 23 fixed to the adjacent arm 14 cooperates. The means 22 and 23 form an encoder which transmits to the electronic control circuit of the apparatus the information relating to the position and if necessary also to the speed of displacement of the carriage 13 with the gripping hands 11, 111. In Figure 1, 24 denotes the tracked channel fixed with one end to the arm 114 and fixed with the other end to an ancillary part of the carriage 13 and which carries the lines for supplying the actuators 12, 112 and the electric cables connected to optoelectronic sensors, for example photocell sensors 25, 125, 225 which are mounted on a pair of rods 26, 126 which are fixed perpendicularly onto the side of the cross-piece 113 of the carriage 13 which is directed towards the load C. The photocell 25 comprises means for transmitting and for receiving a light ray which, when the arms 14, 114 are in the vertical position, is aimed at the load C and this photocell is used to adapt automatic operation of the apparatus to the height of the said load C positioned in case on the rotating table T of the wrapping machine (see below). The photocells 125, 225 communicate instead with each other via a light ray parallel to the cross-piece 113 of the carriage 13 and are used as safety devices for stopping operation of the apparatus in the case where these photocells detect the presence of foreign bodies in their field of action (see below). The bottom ends of the arms 14, 114 are fixed to the vertical extensions of respective plates 27, 127 in the form of a right-angled triangle which, with their angle portion not affected by the said arms, are directed towards the wrapping machine and are keyed onto a robust shaft 28 which is parallel to the said shaft 20, which has the function of connecting mechanically together the said arms 14, 114 and which, with its ends, is supported rotatably by supports 29, 129 which are fixed onto shoulders of suitable height

301, 301' which are integral with the base 1 of the apparatus. One end of the shaft 28 projects from the support 29 and is keyed to a reduction gear unit 30 with an electric motor rotating in both directions and flanged onto a plate 31 fixed at 32 to the base 1. The plate 31 supports, projecting above the unit 30, a segment 33 with holes and/or teeth with which one or more sensors and/or other safety and/or process devices 34 mounted on the adjacent plate 27 of the arm 14 cooperate. The devices 33 and 34 also form part of an encoder which transmits to the electronic control circuit of the apparatus the information relating to the angular position and if necessary also the pivoting speed of the arms 14, 114. When the arms 14, 114 are in the vertical position at the start of the cycle, the bottom closed ends of the said arms rest on the shoulders 301, 301' via damping devices 35 consisting for example of rubber pads.

[0007] In order to facilitate operation of the unit 30 for pivoting the arms 14, 114, the shaft 28 may have, keyed thereon, at least one possible counterweight 36 (Fig. 2) for balancing the weight of the said arms and the carriage 13 movable on the latter. The apparatus as described functions in the following manner: As already mentioned, at the start of each cycle the arms 14, 114 are in the vertical position, as can be seen in Figures 2 and 3. The carriage 13 is raised into the upper end of travel position and is then lowered so as to detect with the photocell 25 the height of the load C positioned in the wrapping station, and the downward movement of the said carriage 13 continues as far as the bottom end-of-travel position where the hands 11, 111 are open and positioned inside the slits 10, 110 of the fixed gripper 4 where the hands are in phase sequence actuated so as to close and grip the front end of the film which is retained by the said gripper 4. In phase sequence the gripper 4 opens, as shown in Figure 5, and the carriage 13 is raised so as to extract from the said gripper 4 a section of film of predefined length, following which the said gripper 4 is actuated so as to close, as shown in Figure 6 and in phase sequence, following a command received from the control panel Q of the wrapping machine, displacement of the carriage 108 of the actuator 8 is activated so that the blade 9 cuts the film retained at the top by the hands 11, 111 and at the bottom by the gripper 4, immediately above this gripper and parallel to the latter, such that the hands 11, 111 have, hanging from them, a sheet of film 103 with the dimensions necessary for covering the load being wrapped. The carriage 108 with the blade stops therefore at the other end of the actuator, outside of the film, and remains on standby for the next working cycle. When the load C has stopped and is correctly positioned with respect to the apparatus in question, the unit 30 is actuated and causes pivoting of the arms 14, 114 towards the said load, as shown in Figure 1, while depending on the height of the said load detected previously and owing to a suitable software which controls operation of the apparatus, the carriage 13 is gradually raised so that the cross-piece 113 with the closed hands 11, 111 has to pass over the

said load and position correctly on the latter the sheet of film 103, substantially as if it were being placed by the hands of an operator, and when the film is already resting on the load and the hands have moved downwards by the appropriate amount underneath the level of the top of the said load C, in phase synchronism the said hands 11, 111 are opened and the arms 14, 114 are raised again and brought back gradually into the vertical start-of-cycle position, while the carriage 13 is raised and remains in the high position waiting for a new working cycle. It is obvious from Figure 1 how the apparatus according to the invention may be packaged and dispatched already assembled and ready for use, with the manipulator arms 14, 114 in the lowered position on the rotating table T, so as to occupy a volume heightwise which is very small.

[0008] It is understood that the description refers to a preferred embodiment of the invention, to which numerous variations and constructional modifications may be made, these relating for example to the fact that the straight manipulator arms 14, 114 may be replaced with robot arms which with their forearm support the cross-piece 113 via the gripping hands 11, 111.

Claims

1. Apparatus for automatically placing a covering sheet over the top of a load, usually palletized, during wrapping with stretch film, **characterized in that** it comprises a dispensing gripper (4) which retains the front end of a film unwound from a parallel reel (3) supported rotatably by special means (2) and which leaves, free, portions of the said front end of the film, which are gripped in phase synchronism by the hands (11, 111) of a pivoting-arm manipulator (14, 114) which, in synchronism with temporary opening of the said gripper, is actuated so as to extract from the latter a section of film with the length necessary for forming the said sheet for covering the load, which sheet is retained at the tail end by the same gripper when actuated so as to close and is then separated from the film downstream by the intervention of transverse cutting means (9), means being envisaged for subsequently causing the said manipulator to pivot about its own fulcrum so as to deposit the sheet of film (103) with sufficient centring, over the top of the load (C) to be wrapped which is temporarily stationary, following which the said manipulator abandons the sheet and returns, with a pivoting movement in the opposite direction to the previous pivoting movement, into the position useful for repetition of a new working cycle.
2. Apparatus according to Claim 1), **characterized in that** it comprises means which allow stowing away of the pivoting-arm manipulator (14, 114) into a low position directed towards the machine for wrapping

the palletized load, so that the said apparatus occupies a limited amount of space during storage and transportation.

3. Apparatus according to Claim 1), in which the gripper for dispensing the film (4) is positioned parallel to and above the reel (3) from which the said film is unwound and is supported at the ends by upper brackets (105) of a pair of uprights (5) integral with the base structure (1) which carries the rollers supporting the said reel, the said gripper being provided with a jaw (104) fixed to the said brackets (105) and provided with a movable jaw (204) which travels on sliding blocks (6) with a low coefficient of friction and which is displaced by the action of a pair of small rectilinear actuators (7) fixed for example with their body to the outer side of the said movable jaw and fixed with their stem to the said fixed jaw (104), at least one or both the internal and opposite surfaces of the said jaws (104, 204) being lined if necessary with suitable material.
4. Apparatus according to Claim 3), in which a rectilinear movement actuator (8) is arranged on the outer side of the fixed jaw (104) of the dispensing gripper (4), parallel to the said gripper, said actuator also being supported at the ends by the brackets (105) which support the said dispensing gripper and this actuator has, sliding on it, a carriage (108) which supports a blade (9) situated transversely and just above the said gripper (4) with its flat and cutting part which, in plan view, has preferably the shape of a spear head, with two cutting and inclined sides so as to cut both during the outward stroke and during the return stroke, it being envisaged that the carriage with this blade is usually at rest on one of the two ends of the associated actuator (8) so that the blade (9) is situated at a short distance from one of the sides of the front end of the film retained by the dispensing gripper (4).
5. Apparatus according to Claim 1), in which the hands (11, 111) for gripping the portions of the front end of the film which are left exposed by corresponding slits (10, 110) of the dispensing gripper (4) are mounted with the associated self-centring actuators (12, 112) on the cross-piece (113), parallel to the said gripper (4), of a carriage (13) which with its sides (213, 213') travels on a pair of straight and parallel manipulator arms (14, 114) which at the start of each working cycle are in a vertical position, the sides (213, 213') of the said carriage (13) being slidable with its rolling means (15) on straight guides (16) fixed longitudinally inside the said arms (14, 114) and the said sides of the carriage being fixed via respective ancillary parts (17) to the section of corresponding toothed belts (18, 118) which are endlessly wound and driven on driving pulleys (19) mounted on the bottom end

of the said arms and on pulleys (119) mounted idle and adjustable on the top end of the said manipulator arms (14, 114).

6. Apparatus according to Claim 5), in which the said driving pulleys (19) are keyed onto a shaft (20) mounted rotatable on the bottom ends of the manipulator arms (14, 114) one of which supports, externally fixed thereto, a reduction gear unit (21) with an electric motor rotating in both directions, which actuates the said shaft (20) which is provided on one end with a wheel having, teeth, eyelets or holes (22) with which a sensor (23) fixed to the adjacent arm (14) cooperates, all of which so as to provide with these means (22, 23) an encoder able to transmit to the electronic control circuit of the apparatus the information relating to the position and, if necessary, also to the speed of displacement of the carriage (13) with the gripping hands (11, 111).
7. Apparatus according to Claim 5), in which the end of a tracked channel (24) is fixed onto one of the manipulator arms (14, 114) and is fixed with the other end to an ancillary part fixed to the cross-piece of the carriage (13) with the hands (11, 111) for gripping the film, the channel having, arranged inside it, the lines for supplying the actuators (12, 112) actuating the said hands as well as the electric cables connected to optoelectronic safety and process sensors mounted on the said cross-piece of the carriage with the hands (11, 111).
8. Apparatus according to Claim 7), in which the said optoelectronic sensors comprise photocells (25, 125, 225) mounted on a pair of rods (26, 126) fixed perpendicularly on the side of the cross-piece (113) of the said carriage (13) which is directed towards the load (C) to be wrapped, one of the said photocells (25) being provided with means for transmitting and for receiving a light ray which, when the manipulator arms (14, 114) are in the vertical position, is aimed at the load (C) and this photocell is used to adapt automatic operation of the apparatus to the height of the said load (C) in each case positioned in the wrapping machine, while the other two photocells (125, 225) communicate with each other via a light ray parallel to the said cross-piece (113) of the carriage (13) and are used as safety devices for automatically stopping operation of the apparatus in the case where these photocells detect the presence of foreign bodies in their field of action.
9. Apparatus according to Claim 5), in which the bottom ends of the manipulator arms (14, 114) are fixed to the vertical extensions of respective plates (27, 127) in the form of a right-angled triangle which, with their angle portion not affected by the said arms, are directed towards the wrapping machine and are keyed

to a robust shaft (28) which has the function of connecting mechanically together the said arms (14, 114) and which with its ends is supported rotatably by supports (29, 129) fixed on shoulders of suitable height (301, 301') integral with the base (1) of the apparatus, one end of the said shaft (28) projecting from the associated support (29) and being keyed to a reduction gear unit (30) with an electric motor rotating in both directions, which transmits the necessary pivoting movement in both directions to the manipulator arms and which is flanged onto a plate (31) fixed to the said base (1).

10. Apparatus according to Claim 9), in which the said plate (31) supports, projecting above the reduction gear unit (30), a segment with holes and/or teeth (33) with which one or more sensors and/or other safety and/or process devices (34) cooperate, said devices being mounted on the adjacent plate (27) of an arm (14), all of which so as to form an encoder which transmits to the electronic control circuit of the apparatus the information relating to the angular position and if necessary also the pivoting speed of the manipulator arms (14, 114).
11. Apparatus according to Claim 5), **characterized in that**, when the manipulator arms (14, 114) are in the vertical start of cycle position, the bottom and closed ends of the said arms rest on the support shoulders (301, 301') with damping devices (35) consisting, for example, of rubber pads.
12. Apparatus according to Claim 5), **characterized in that**, in order to facilitate operation of the reduction gear unit (30) for pivoting the manipulator arms (14, 114), the shaft (28) acting as fulcrum for these arms may have, keyed thereon, at least one possible counterweight (36) for balancing the weight of the said arms and the carriage (13) movable on the latter.
13. Apparatus according to Claim 1), **characterized in that** it comprises means so that, at the start of each working cycle, when the manipulator arms (14, 114) are in the vertical position, the carriage (13) is firstly raised into the upper end-of-travel position and is then lowered so as to detect with the photocell (25) the height of the load (C) placed in the wrapping machine and the downward movement of the said carriage (13) continues as far as the bottom end-of-travel position where the hands (11, 111) are open and positioned in the slits (10, 110) of the fixed dispensing gripper (4) where the said hands are in phase sequence actuated so as to close and grip the front end of the film which is retained by the said gripper (4) which in sequence opens, while the carriage (13) is raised so as to extract from the said gripper (4) a section of film of predefined length, following which the said dispensing gripper is actuated so as to close.

14. Apparatus according to Claim 13, **characterized in that** it comprises means so that, following a command received from the control panel (Q) of the wrapping machine, the displacement of the carriage (108) of the actuator (8) is actuated in sequence so that its blade (9) cuts the film retained at the top by the hands (11, 111) and at the bottom by the dispensing gripper (4), immediately above this gripper and parallel to the latter, such that the hands (11, 111) have, hanging from them, a sheet of film (103) with the necessary dimensions for covering the load being wrapped, it being envisaged that the said carriage (108) with the blade stops in the end-of-travel position on the end of the actuator opposite the starting position, outside of the film and it being envisaged that it remains here on standby for the next working cycle.
15. Apparatus according to Claim 14), **characterized in that** it comprises means such that, when the load (C) has stopped and is correctly positioned with respect to the said apparatus in question, the drive unit (30) is operated and causes pivoting of the manipulator arms (14, 114) towards the said load while, depending on the height of the latter, detected previously and by means of a suitable software which controls operation of the apparatus, the carriage (13) is gradually raised so that its cross-piece (113) with the hands (11, 111) closed have to pass over the said load and position correctly on the latter the sheet of film (103), substantially as if it were placed by the hands of an operator, and when the film is already resting on the load and the hands have moved downwards by an appropriate amount underneath the level of the top of the said load (C), in phase synchronism the said hands (11, 111) are opened and the arms (14, 114) are raised again and brought back gradually into the vertical start-of-cycle position, while the said carriage (13) is raised and remains in the high position waiting for a new working cycle.
16. Apparatus according to the preceding claims, **characterized in that** the straight manipulator arms (14, 114) may be replaced by robot arms which with the forearm support the cross-piece (113) with the gripping hands (11, 111).

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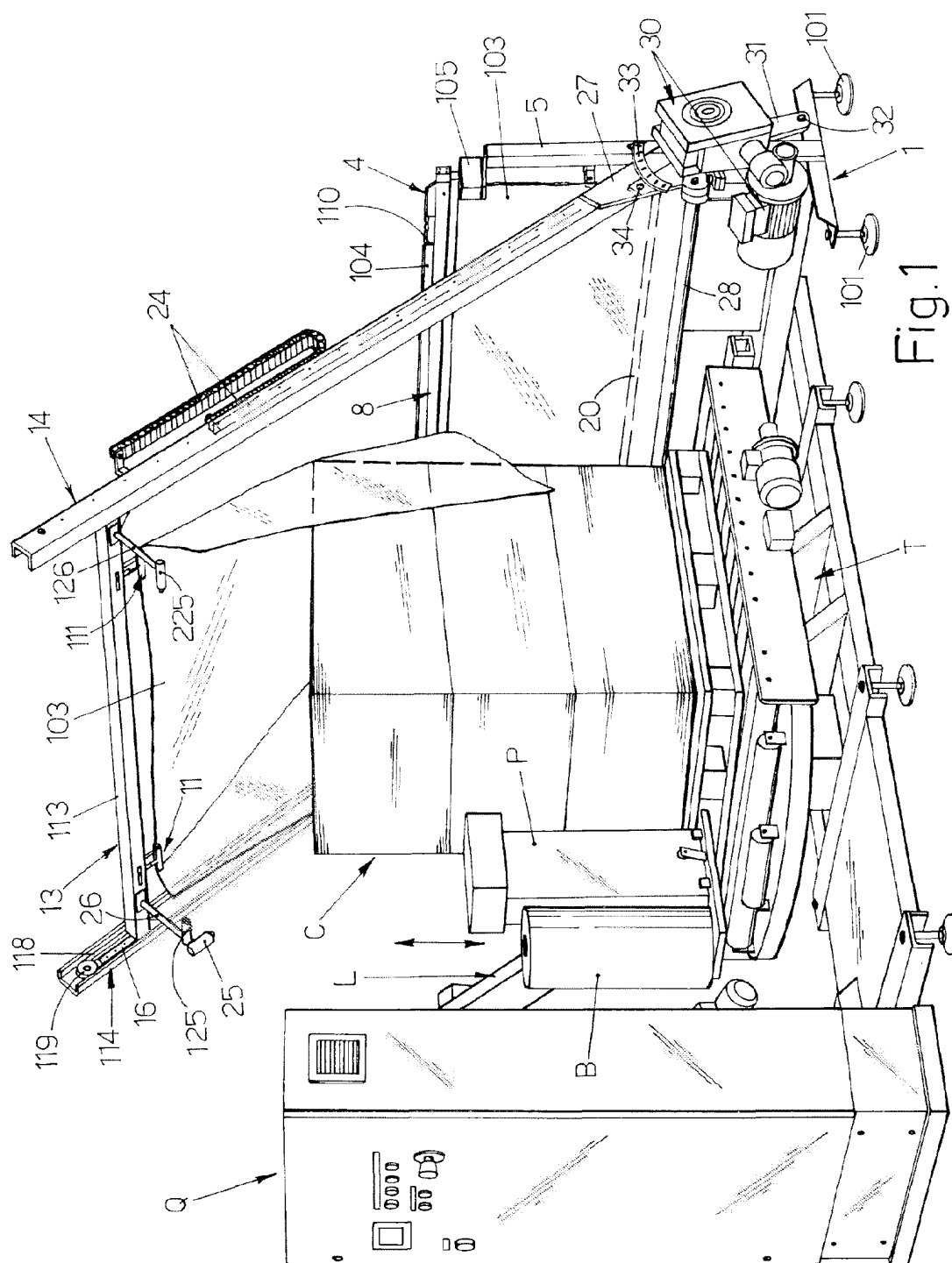
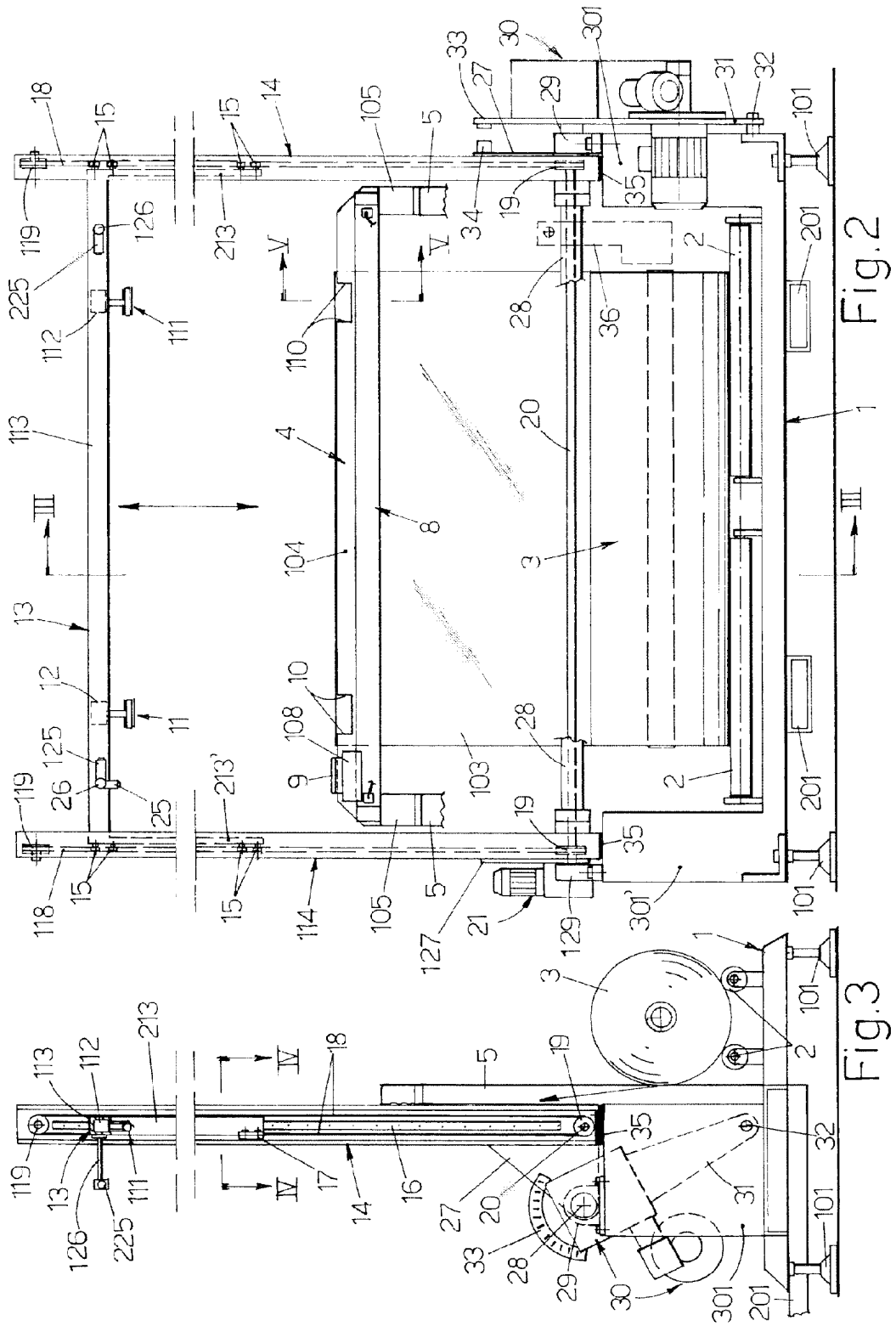
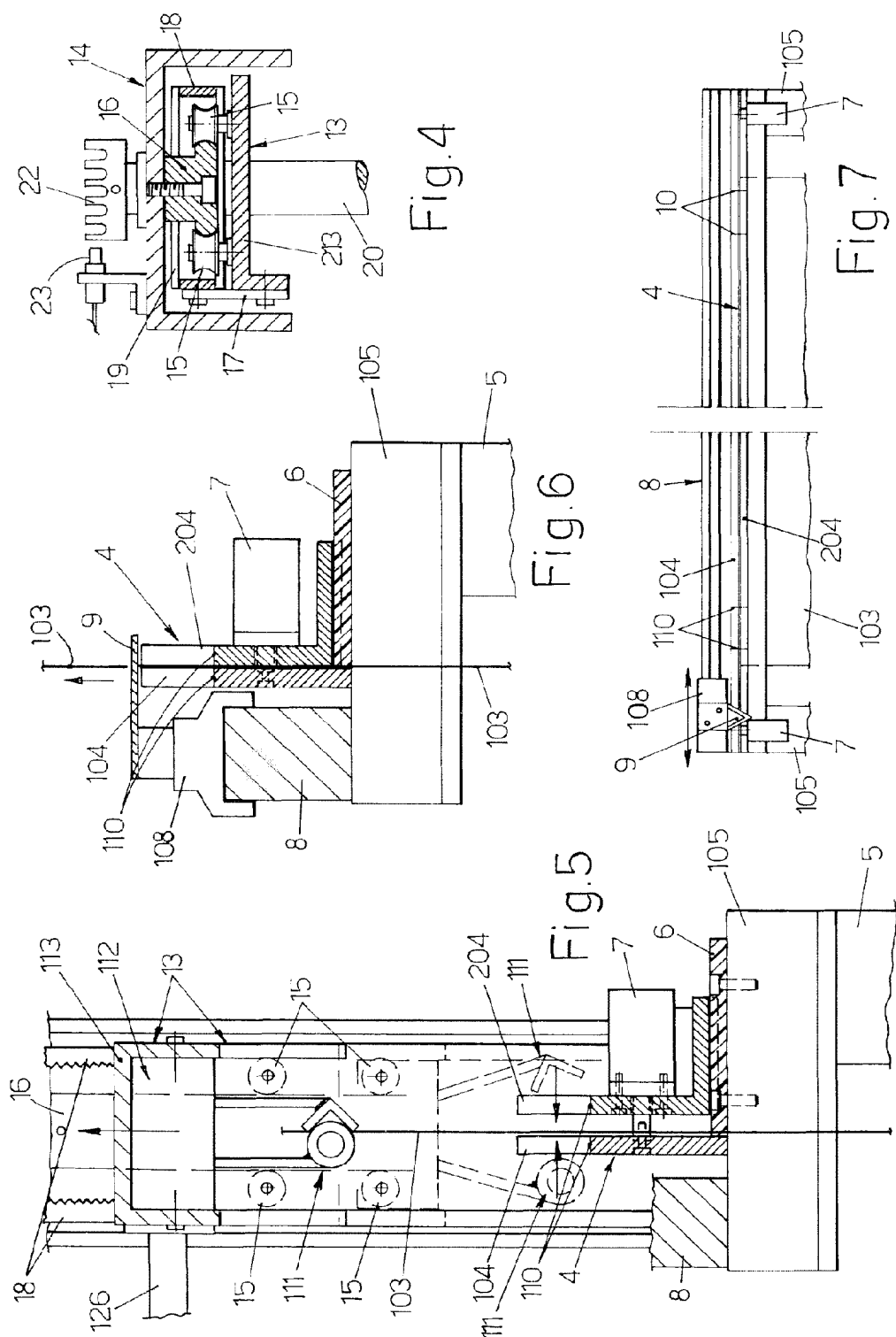


Fig. 1







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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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